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ABSTRACT

This study analyzed the growing body of research on self regulation and the distinctive self regulation differences between higher and lower achieving adult learners to identify instructional principles to infuse compensatory support for weak self regulation. The following four principles are proposed: (1) prepare--the instruction should encourage and guide learners to prepare appropriate learning environments; (2) organize--the instruction should include different arrangements of the learning materials that will facilitate learning and the learner's cognitive and metacognitive strategy use; (3) monitor--prompt the learner to record how and when he or she engages in learning and the results of the effort; and (4) evaluate--instruction should enable learners to determine how well they have learned. A rationale based on research supports each principle, and instructional application examples are included. (Contains 45 references.) (MES)

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Instructional Principles for Self Regulation

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Abstract

While there have been studies investigating the effect of instructional interventions, few systematic principles have been identified for providing support for learners who are poor self regulators. We analyzed the growing body of research on self regulation and the distinctive self regulation differences between higher and lower achieving adult learners to identify four instructional principles to infuse compensatory support for weak self regulation. A rationale based on research supports each principle and instructional application examples are included.

Introduction

A plethora of research describes how learner individual differences influence the effectiveness of instruction although only recently have instructional designers proposed seminal instructional guidelines for addressing learner differences to improve learning outcomes (Jonassen & Grabowski, 1993). Even more recently instructional designers began investigating the role of self regulation (SR), an important individual difference, in instruction (Young, 1996). Self-regulation determines how students personally activate, alter, and sustain their learning (Zimmerman & Martinez-Pons, 1986). Students are self-regulated to the degree that they are metacognitively, motivationally, and behaviorally active participants in their own learning process (Zimmerman & Martinez-Pons, 1986). Students who engage in self-regulation take responsibility for and initiate their own efforts to acquire skill and knowledge instead of depending upon external sources (Zimmerman Martinez-Pons, 1988). Students who self regulate learning have accessed metacognitive strategies, were more aware of their limitations, and have taken steps to correct deficiencies (Zimmerman & Martinez-Pons, 1995). Self regulated learners continually plan, organize, monitor, and evaluate their learning processes (Corno, 1989; Hagen & Weinstein, 1995; Zimmerman & Paulsen, 1995).

SR has been consistently related to achievement in learners across age groups. Ninety-three percent of 80 high school participants were correctly classified into preassigned high/low achievement tracks based on strategy use indicators (Zimmerman & Martinez-Pons, 1986). In a subsequent study with participants from fifth, eighth, and eleventh grades, students who were classified as gifted reported significantly greater use of self-regulated learning strategies than did students classified as regular achieving (Zimmerman & Martinez-Pons, 1990). Six SR strategies correlated positively with college statistics student's exam scores: self evaluation, seeking information, rehearsal and memorization, reviewing texts, and reviewing tests (Lan, 1998).

Fortunately, SR is not inherent but is a learned response that can be taught and controlled by the student (Iran-Nejad, 1990). Furthermore, even though a student is already exhibiting self-regulation, these processes can be enhanced to better support learning, motivation, and performance (Pintrich, 1995). Preservice teachers enrolled in education courses have benefited from instruction that supported self-regulated learning strategies such as cognitive skill instruction, effort reinforcement, and metacognitive skill use (Schutz, Lanehart, & White, 1995). Metacognitive strategy instruction when embedded in content instruction has improved student achievement (Nist, Simpson, Olejnik, & Mealey, 1991). Structuring regulatory strategies within instruction has improved achievement in college statistics students (Lan, 1998). The evidence from intervention studies on one or more of the SR processes suggests that instruction that supports regulation improves learning outcomes.

Better learners probably employ some of the strategies associated with SR to compensate for cognitive deficiencies (Di Vesta & Moreno, 1993). Given that SR activities may be increased through instruction, poor SR is a set of learner activities for which instruction may be able to compensate. Compensating regulatory instruction may moderate the negative impact of poor SR on achievement. For learners who are less self regulated, the instructional environment may compensate for poor SR skills with external regulatory instructional interventions. Instruction that includes lower achieving learners in the target population may be able to improve learning outcomes if the design promotes compensatory SR strategies.

While there have been studies investigating the effect of SR instructional interventions (Hattie, Biggs, & Purdie,1996; Lan, 1998; Young, 1996), and SR models for instruction (Schunk & Zimmerman, 1998) and cognitive models of SR based upon the expert, highly self regulating learner (c.f., Winne, 1995), few systematic principles have been identified for providing support for poor self regulators based upon their SR weaknesses. Some SR interventions have been content specific, such as writing (Graham, Harris, & Troia, 1998), reading comprehension (Pressley, El-Dinary, Wharton-McDonald, & Brown, 1998), or mathematics (Schunk, 1998). Others have included

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effective college learning to learn courses (Hofer, Yu, & Pintrich, 1998) or have described "computer supported tools" to guide learner SR (Winne & Stockley, 1998, p.133). Other approaches are directed toward specific populations such as adolescents (Belfiore & Hornyak,1998), learning disabled (Butler,1998), and children (Biemiller, Shany, Inglis, & Michenbaum,1998; c.f. , Corno, 1995). Some SR instructional models have approached the problem from the teacher's but not the designer's perspective (c.f., Schunk & Zimmerman, 1998); in fact, "most existing applied research on SRL has identified ways teachers can improve or promote SRL (Corno, 1995, p. 201)."

Few SR principles or models have been based upon empirically supported SR needs, that is, discrepant SR activities associated with achievement. Evidence suggests that the closer the match between learner SR needs and the instructional environment, the more positive the learning results (Young, 1996; Ertmer, Newby, & MacDougall, 1996). A meta-analysis analysis with study participants across K-16 indicated that learning has resulted from learning skill interventions although improved outcomes were less likely when the intervention targeted a selected deficit rather than multiple deficits (Hattie, Biggs, & Purdie, 1996). Furthermore, because SR may be a developmental process which takes years and aging and even then may not transfer well (Pressley, 1995), the more that instruction can prompt or foment regulation, the more the poorly self regulated learner may learn. Instruction that follows principles for SR may bridge the gap between unacceptable and sufficient learning outcomes. Indeed design principles may be indispensable to instructional environments for the learner without SR expertise.

Instructional principles that guide the coordination between learner needs and the instructional environment might result in more effective instruction although the instructional design literature lacks general instructional design principles to facilitate the match between SR needs and instruction. We propose four instructional design principles, independent of content or a delivery media, to address discrepant SR activities associated with achievement. We have drawn upon two bodies of literature to derive the four SR principles. The first source is the a large body of research encompassing SR and the many individual factors that affect or comprise SR, e.g., achievement levels, metacognition, academic time management. The second source, research on SR characteristics associated with achievement, included three empirical studies: the first validated an SR interview measure that classified learners as higher or lower achieving (Zimmerman & Martinez-Pons, 1995); the second classified adult learners into normal and lower achieving with the same SR interview measure (Ley & Young, 1998); and a third analyzed SR differences between adult learners who used a SR instructional protocol and those who did not (Lan, 1998). We first analyzed research on learner behaviors associated with SR. We then analyzed the significant SR differences between higher and lower achieving learners. Finally we generated principles derived from the research on SR influences to address the significant SR differences associated with achievement.

Salient SR Activities

Two studies (Lan, 1998; Ley & Young, 1998) have classified discrepant SR activities among college learners according to categories and measures developed through the research of Zimmerman and Martinez-Pons (1986) (See Table 1). Each study measures SR in the same categories although one was a Likert scale and one was an interview. Since SR data collected with Likert scales lack validity that interview measures overcome with lower achieving adults the interview was used to collect data (Ley & Young, 1998; Young & Ley, 1997). Based upon structured interviews, five categories of strategy use were significantly different between normal and lower achieving adults (Ley & Young, 1998). The five categories were, in order from the strongest relationship, self evaluation, environmental structuring, organizing and transforming, reviewing tests, and keeping records and monitoring.

Three of the SR strategies that differentiated between normal and lower achieving adults (Ley & Young, 1998) were also significantly different between adult learners who did and did not use an instructional self monitoring protocol (Lan, 1996): environmental structuring, reviewing tests, and self evaluation. The significant SR differences between learners who were required to use an instructional self monitoring protocol and those who did not, in order from the strongest relationship, were environmental structuring, reviewing tests, self evaluation, and rehearsing and memorizing. Using the self monitoring protocol was also associated with significantly higher exam scores. In both studies, seeking assistance with peers significantly differed but the relationship was negative; peer assistance seekers were more likely to be either the lower achieving learners (Ley & Young) or not to have used the self monitoring protocol (Lan).

Table 1. Self Regulation Categories (from Zimmerman & Pons, 1986)

1. Self evaluation (1,3)– student initiated evaluations on the quality of completed work.
2. Organizing and transforming (3,0)– overt or covert rearrangement of instructional materials to improve learning, e. g., outlining before writing a paper
3. Goal-setting and planning – student-identified desirable educational outcomes or subgoals and planning for sequencing, timing, and completing activities related to goals
4. Seeking information – student-initiated efforts to secure further task information from nonsocial sources when undertaking an assignment, e. g., searching the internet
5. Keeping records & monitoring (5, 0)– student-initiated efforts to record events or results
6. Environmental structuring (2, 1) – student-initiated efforts to select or arrange the physical setting to make learning easier
7. Self consequences – student arrangement of rewards or punishment for success or failure
8. Rehearsing & memorization (0, 4) – student-initiated efforts to memorize material to overt or covert practice
9. Seeking assistance from experts/teachers – student-initiated efforts to solicit help from experts or faculty
10. Seeking assistance from peers[1] – student-initiated efforts to solicit help from other learners.
11. Reviewing tests (4, 2) – student-initiated efforts to reread tests to prepare for class or further testing
12. Reviewing notes – student-initiated efforts to reread notes to prepare for class or further testing
13. Reviewing texts – student-initiated efforts to reread textbooks to prepare for class or further testing

Note. The first and second number in parentheses represent the rank by strength of significant relationships, respectively, between lower and normal achieving adults (Ley & Young, 1998) and adult users and nonusers of a self monitoring instructional protocol the (Lan, 1996).
[1] This was the only significant negative relationship between lower and normal achieving adults (Ley & Young, 1998) and adult users and nonusers of a self monitoring instructional protocol (Lan, 1996)

Compensatory SR Principles

We propose four instructional design principles to infuse compensatory instructional support for adult SR deficiencies. Instruction that accounts for SR may be essential for effective instruction with low achieving, under prepared, or ineffective learners. Both more and less self regulated learners should benefit from the regulatory support the principles prescribe by embedding SR strategies in instruction to compensate for SR deficiencies. For the less self regulated learner, the instruction would embed information and activities to compensate for SR weaknesses; the same information and activities should further encourage SR among more skillful learners.

More self regulating adult learners may benefit from a reduction of the cognitive load SR imposes thereby allowing the learner to spend less effort on SR activities. Many adult students often have job and family responsibilities that compete with educational commitments for their time and energy; course-embedded SR guidance gives the learner SR tools and strategies that he or she may otherwise have to take time to construct or identify. Learner may spend time deploying the SR strategies instead of creating them.

We present four principles, each with a rationale, and one for each of four broad categories of SR activities: preparing, organizing, monitoring, and evaluating. The definitions for each of the processes were adapted from the work of Zimmerman and Martinez-Pons (1986) (See Table 1). The instructional principles are adaptable across media so that, for example, an instructor, CAI, or web site could be the instructional media for providing compensatory SR activities.

Principle 1: Prepare

The instruction should encourage and guide learners to prepare appropriate learning environments.

Rationale

Environmental structuring, that is selecting and arranging the physical setting to make learning easier, has been strongly associated with SR. Arranging the physical setting was the second strongest predictor achievement levels between normal achieving and lower achieving, under prepared college students (Ley & Young, 1998); it was the strongest difference between college students who used an instructional self monitoring protocol and those who did not (Lan, 1996). The learners who recorded their study behaviors with the protocol reported significantly greater environmental structuring and earned significantly higher exam scores than those who recorded instructor behaviors or did no recording. Structuring the environment includes the learner's ability to cope effectively with disturbances, a crucial part of self regulation and volition (Corno, 1994).

Preparing Strategies

Include as part of the instruction techniques and exercises for establishing a study area that is quiet, comfortable, without distractions; encourage learners to analyze how and when to effectively control distractions (c. f., Corno, 1994). Suggest that students find a quiet place to work and eliminate distractions such as phone calls and noise. Suggestions to eliminate explicitly identified distractions could be included with a first assignment. For example, in a distance course, students who do poorly on the first assignment could receive counseling on structuring their study environment (c. f., Corno).

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Instruction should require students to establish a study environment with the characteristics that facilitate concentration and attention. For example, the instruction could include a checklist that would require students to confirm they have established an appropriate study environment that is free from distractions such as television and noise. Instruction could require learners to record the amount of time spent studying in this environment and submit the record as a learning requirement. This strategy encourages the student to reflect upon how prepared he or she is to study and encourages the learner to prepare the environment in which he or she will be able to study most effectively.

Principle 2: Organize

The instruction should include different arrangements of the learning materials that will facilitate learning and the learner's cognitive and metacognitive strategy use.

Rationale

Organizing and transforming activities were the third strongest predictor of achievement level between normal and lower achieving college students (Ley & Young, 1998). Matching appropriate strategies to outcomes has improved learning outcomes (McKeague & Di Vesta, 1996). Learners have benefited from meaningful and directed practice (Karabenick & Knapp, 1990) and from using cognitive and metacognitive strategies (Brozo, Stahl, & King, 1996; Davis, 1994; Frazier, 1993; Nist & Simpson, 1990). Learners tend to use study strategies because they are familiar not because they are effective (Garner, 1990) therefore the instruction can extend the range of strategies by structuring how to learn the targeted skill or concepts. Because to some extent SR is a content dependent activity (Alexander, 1995), including proven content specific learning approaches should strengthen the instruction by presenting effective ways to learn a particular domain.

Organizing strategies

The instruction might suggest or require the learner to use a specified order and approach for learning concepts and skills taught in a module. Study techniques for learning particular skills, such as mathematics or reading comprehension, may be included with examples or demonstrations of cognitive and metacognitive strategies (c. f., Hofer, Yu, & Pintrich, 1998). The instruction could include content outlines or advance organizers that will structure the learning sequence and identify concepts for individual modules and, with less detail, for a course. Unit glossaries or graphic organizers could define and present relationships among concepts and skills presented in the instruction.

Principle 3: Monitor

Prompt the learner to record how and when he or she engages in learning and the results of the effort.

Rationale

"Self monitoring is an important component of self regulated learning . . . and faculty can help students learn how to self monitor" (Zimmerman & Paulsen, 1995, p. 13). Self regulators use external and internal feedback to monitor how well they are meeting learning goals, how effective their learning strategies and tactics are, and the quality of their learning outcomes (Butler & Winne, 1995). Feedback "is inherent in and a prime determiner of processes that constitute SR learning" (Butler & Winne, p. 245). Learners who exercise metacognition are aware of their own learning processes, the results of the processes, and can adjust their behavior or thinking to improve or correct deficient learning processes (Gagne & Glaser, 1987). They monitor their progress by using metacognitive strategies to adjust cognitive strategies that compensate for progress or difficulties (Garner, 1990; Pressley, Woloshyn, Lysynchuk, Martin, Wood, & Willoughby, 1990; Ridley, Schutz, Glanz, & Weinstein, 1992). Learners who recorded their learning activities on a self monitoring protocol scored higher on examinations than did learners who recorded teacher activities or did not record either (Lan, 1996).

Monitoring strategies

Instruction may include a form for monitoring learning activities and require the learner to log her time spent on learning activities such as taking notes in class, reading the text, attending a lecture, working homework problems, etc. (c. f., Lan, 1998). The instruction may require the learner to submit his progress tracking as part of the instructional process. The instruction should present explicit interim process and product assignments that are the occasion for feedback and that lead the student to the desired learning goals.

The instructional process should offer the learner frequent feedback on interim process and product assignments that includes whether his or her response is correct or not, why it is incorrect, and how to correct the response. The instruction should allow for the external feedback on interim process and products that the student submits on the way to the terminal learning outcome. For example, if the learning goal is to write a technical report,

the instruction may require the learner to submit and receive feedback first on the quality of the learner's proposed information sources, then an outline of the report, followed by feedback on a draft of the report, graphics that support the report, etc. In other words the instruction incorporates learner performances and learner feedback on many, if not most, of the component activities in the order in which they are accomplished to produce the desired learning goal.

Instruction might deliver to learners frequent printed progress reports that compare what they have learned or accomplished to date to what future assignments will be required to meet the instructional goal. Feedback should indicate progress toward learning goals, that is, mastery and what the learner should know or be able to do, and not toward performance goals, that is, scores, grades, relative standing since a wealth of research indicates the former are associated with higher achievement and the latter are counterproductive (Hagen & Weinstein, 1995). Therefore Feedback which includes scores should reflect degree of mastery not relative standing in a group of learners.

Principle 4: Evaluate

Instruction should enable learners to determine how well they have learned. Self evaluation occurs when the student reflects upon the quality of his or her completed work to prepare for further learning or performance evaluations. Similar to monitoring, self evaluation entails learner comparisons between what he or she has accomplished to a standard or goal.

Rationale

Self evaluation processes have been significantly weaker in low achieving high school students (Zimmerman & Pons, 1990) and college students (Lan, 1996; Ley & Young, 1998) when compared to their higher achieving counterparts. Furthermore, higher achieving students review previous tests significantly more than do lower achieving college students (Lan, 1996; Ley & Young, 1998). For instructional purposes, reviewing tests serves the same function as self evaluation because both induce the student to reflect upon instances in which the quality of his or her learning fell short of the quality required. College statistics students who recorded their study behaviors reported reviewing previous tests significantly more often than did those who recorded instructor behaviors or did no recording (Lan, 1998). Less regulated learners do not attend to their own course progress with the same diligence as the more self regulated learners.

Evaluating strategies

Instruction should require learners to submit and receive feedback on interim learning processes and products. For example, computer based instruction which tests a learner frequently and provides the learner with explicit feedback on what he or she is and is not learning supports self evaluation and compels the learner to review of test materials. Computer based instruction that prompts students to use learning processes encourages self regulation (c. f., Winne & Stockley, 1998). Instructors who initiate frequent graded or ungraded tests followed by their in-class review of the test with corrective feedback would assure learner self evaluation and test review. To further compel students to review their work, instruction might require learners to suggest how they might improve the quality of a product based on external feedback provided through the instruction or the instructor. Another technique especially adaptable to distance learners would be to use the same performance criteria as the learner's quality control checklist during assignment preparation and as an evaluation checklist during feedback as part of a multi-step process: (a) provide the learner with a set of measurable criteria for a product or process in the format of a checklist, (b) instruct the learner how to use the criteria as a quality control checklist when preparing the activity or completing the product, and (c) provide the learner with feedback on the quality of the learner's completed process or product using the same criteria checklist (Ley, draft).

Conclusion

Several distinct activities and cognitive processes comprise self regulation and a select few of them differ between higher and lower achieving adult learners. Low achieving learners will do far better when their choices instructional choices are limited by high structure (Kulik & Kulik, 1991). Lower achieving learners are more likely to be poor self regulators and to benefit from the high structure inherent to the SR principles. The SR principles guide the design process so that the learner is not left to choose his or her learning environment. Although SR is to some extent context dependent, instructional designers should consider using a framework of general principles that have been developed to address the distinct SR deficiencies associated with achievement levels among adult learners.

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